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**United States Patent** [19]**Mariant et al.**[11] **Patent Number:** **5,639,277**[45] **Date of Patent:** **Jun. 17, 1997**[54] **EMBOLIC COILS WITH OFFSET HELICAL AND TWISTED HELICAL SHAPES**[75] **Inventors:** **Michael J. Mariant**, San Jose;  
**Gregory E. Mirigian**, Fremont; **Nga T. Van**, Santa Clara; **Roberto L. Orellana**, San Jose; **Christopher G. M. Ken**, San Mateo, all of Calif.[73] **Assignee:** **Target Therapeutics, Inc.**, Fremont, Calif.[21] **Appl. No.:** **538,557**[22] **Filed:** **Sep. 29, 1995****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 431,040, Apr. 28, 1995, abandoned.

[51] **Int. Cl.<sup>6</sup>** ..... **A61M 29/00**[52] **U.S. Cl.** ..... **606/191; 606/194; 606/200**[58] **Field of Search** ..... 606/151, 191, 606/200, 194[56] **References Cited****U.S. PATENT DOCUMENTS**

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*Primary Examiner*—Michael Powell Buiz*Assistant Examiner*—Mark S. Leonardo*Attorney, Agent, or Firm*—Morrison & Foerster LLP[57] **ABSTRACT**

This is a surgical device that, in particular, is for forming a vasoocclusion or embolism. Typically, it is a helically wound coil in which the helix is wound in such a way as to have multiple axially offset, longitudinal or focal axes. Another important facet of the invention is the presence of small diameter secondary coil windings adjacent large diameter coil windings. The device is sufficiently flexible and small that it may be delivered to a site within the vasculature of the human body using a pusher and a catheter. The device is generally linear when within the catheter but relaxes to form the multi-focal form after delivery from the distal end of the catheter lumen. Various mechanical connections may also be used to discharge the inventive coil from its pusher. Similarly, the coil may be attached to a pusher using a sacrificial joint, which sacrificial joint is dissolved by imposition of a small voltage within the human body. The device may be used alone or in conjunction with other coils or with a fibrous thrombotic attachments or the substrate to localize subsequent infusion of tissue adhesives, other particulate embolization devices, or chemotherapeutic agents in abnormal blood vessels and tissues.

**23 Claims, 7 Drawing Sheets**